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# Dilaton gravity, (quasi-) black holes, and scalar charge

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## Abstract

© 2014, Springer Science+Business Media New York. Electrically charged dust is considered in the framework of Einstein–Maxwell–dilaton gravity with a Lagrangian containing the interaction term (Formula presented), where (Formula presented) is an arbitrary function of the dilaton scalar field (Formula presented), which can be normal or phantom. Without assumption of spatial symmetry, we show that static configurations exist for arbitrary functions (Formula presented) ((Formula presented)) and (Formula presented). If (Formula presented), the classical Majumdar–Papapetrou (MP) system is restored. We discuss solutions that represent black holes (BHs) and quasi-black holes (QBHs), deduce some general results and confirm them by examples. In particular, we analyze configurations with spherical and cylindrical symmetries. It turns out that cylindrical BHs and QBHs cannot exist without negative energy density somewhere in space. However, in general, BHs and QBHs can be phantom-free, that is, can exist with everywhere nonnegative energy densities of matter, scalar and electromagnetic fields.

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## Keywords

Black holes, Dilaton, Majumdar–Papapetrou systems, Quasiblack holes